

IES

# Newsletter

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## At the Arboretum

We remind our visitors of the new loop on the Cary Pines Trail and of the portion of the Wappinger Creek Trail that has been rerouted. Both these paths lead through old hemlock stands ... cool, peaceful places to spend time during warm summer weather.

The Acid Rain Study Ponds and Pollution Garden are open to the public. For information on these and other IES research displays, see the calendar on the last page of the Newsletter.

Sunday Ecology Programs will continue throughout the summer. Please see the calendar for dates and titles.

The IES Newsletter is published by the Institute of Ecosystem Studies at the Mary Flagler Cary Arboretum. Located in Millbrook, New York, the Institute is a division of The New York Botanical Garden. All newsletter correspondence should be addressed to the Editor.

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## Vegetation Dynamics Along Utility Rights-of-Way

You've seen the wide strips of cleared land zippered with the utility poles and cables that allow electric power to flow across the landscape. How do these green belts remain clear of woody plants? What prevents rapidly growing trees from reaching the high voltage lines? These are questions faced by utility companies, who must ensure that trees in rights-of-way don't grow into the power lines. These are also questions currently being addressed by IES scientists working to understand the natural processes that might prevent trees from becoming established in these areas.

Utility companies currently use both herbicides and mechanical cutting to control tree growth along rights-of-way. Concerns about the costs and environmental effects of herbicides have led them to seek alternatives. In ecological terms, vegetation management along rights-of-way in the northeastern United States is largely an effort to halt or successfully set back a natural process of succession from communities dominated by herbaceous plants and shrubs to forests. Management techniques that involve only repeated cutting of the vegetation at a site can actually stimulate rapid regrowth of the unwanted trees.

For many years, ecologists have been proposing that there are ecological alternatives to the cycle of intensive

management followed by rapid regrowth. One of the strongest proponents of alternative approaches has been Dr. William Niering, of the Connecticut Arboretum, who has documented the persistence of native shrub thickets that show little invasion by trees. The work of Dr. Niering and others suggests that some native communities of low growing plants may act to inhibit the establishment and growth of trees.

In April 1984 representatives from Central Hudson Gas and Electric Corporation met with IES scientists Charles Canham, John Eaton, Gene Likens, Jay McAninch and Mark McDonnell to discuss ecological approaches to managing vegetation along rights-of-way. IES scientists were encouraged to submit a proposal describing their ideas. After an extensive review, the proposal and an addendum were approved by Central Hudson. The project, entitled "Vegetation Dynamics Along Utility Rights-of-Way: Factors Affecting the Ability of Shrub and Herbaceous Communities to Resist the Establishment and Growth of Tall Woody Plants," runs from May 1985 to December 1991. Dr. Canham, a plant ecologist at IES, directs the overall project, with Dr. Alan Berkowitz, Mr. McAninch and Dr. McDonnell as co-investigators.

While Central Hudson serves as the direct sponsor of the research, roughly three-

*continued on page 2*



Young trees are transplanted into a new nursery study. As a part of the IES investigation of plant growth along rights-of-way, the effects of simulated herbivory (using clippers) will be observed. Left to right: Summer project assistants Chris Fox, Andrea Kirn and Michelle Beucler-Gorsira, with Dr. David Wood in the background.

## Rights-of-Way, from page 1

quarters of the funding comes from the Empire State Electrical Energy Research Corporation (ESEERCO). This funding consortium manages research and development money contributed by New York State's utility companies, and a portion of the money is allocated for environmental research.

Untold millions of seeds are produced by trees bordering rights-of-way, but relatively few germinate and survive to emerge above the surrounding shrubs and herbs. What fates do they meet along the way, limiting their growth? To understand better the process of emergence, IES ecologists are looking at factors that affect all stages in the life cycles of trees.

*Seed dispersal* is the first step in a plant's life cycle and also the first stage at which limitation occurs. Under the direction of Dr. Mark McDonnell and research assistant Judi Koch, seed traps -- devices for collecting wind-dispersed seeds -- were placed at random points along rights-of-way. The ecologists are finding that even the wind-dispersed seeds don't travel long distances and are thus most likely to land near the forest edge. Seedling densities of these trees are therefore lower at the centers of rights-of-way.

What happens to seeds once they land at a site? Ground-feeding birds and small herbivorous mammals such as mice and chipmunks can consume large numbers of seeds. This *seed predation* may be a significant cause of mortality, one that will be investigated by the scientists. Those seeds that don't become lunch for local herbivores may *germinate*, but others will rot or die first, reducing the viable population even further. Finally, whether or not *seedling establishment* occurs depends upon how well individual plants compete with the intact vegetation for the nutrients, water and light resources they need for growth.

During the first three years of the study, the scientists and their research assistants worked at over 50 different sites along 966 kilometers (600 miles) of high voltage transmission line rights-of-way in the area served by Central Hudson. From fertile lowlands in Dutchess County to rocky highlands in the Catskills, they sampled the shrub and herbaceous vegetation, the physical environment and all tree seedlings present. Fascinating and complex patterns of seedling invasion were found. Some of the patterns are related to the patchwork of vegetation types found at a given site, while environmental factors (soil moisture and nutrients, light levels) and disturbance history also appear to be important in determining where seedlings occur.

One final study during the first phase of the project addressed the problem of how to control those trees that *do* emerge, without using herbicides. Since cutting is a likely technique, the scientists asked: What

is the best time of the year to cut trees along power lines? The traditional time to cut trees is winter. However, this is also the time when energy for tree growth has already been stored in the roots, and, since most trees along rights-of-way are capable of resprouting when cut, regrowth is rapid in the spring when the energy is released. Dr. Canham and co-workers experimented with cutting trees at different times during the growth season to determine when those reserves had been depleted and new energy not yet stored. Lower carbohydrate levels in the roots should lead to shorter shoots the following season and regrowth should be minimized. Sprout growth is being monitored for two years to gauge the effectiveness of this technique.

Current studies by Dr. Canham and colleagues focus on experiments designed to test ideas and hypotheses generated during the first phase of study. The role of interactions with the intact vegetation, of herbivory, and of physical disturbance in reducing or increasing seedling growth and survival are being assessed. The breadth of these studies, with their focus on many different plant communities and environments, makes this investigation unique in the study of tree seedling establishment.

The importance of resource competition has been difficult to judge in natural communities, but Dr. Alan Berkowitz, an agricultural ecologist with extensive research experience in studying competition among crop plants, and Dr. Canham are directing competition studies along rights-of-way. This summer, tree seedlings will be transplanted into intact communities to measure how the presence of the natural vegetation affects seedling growth. Results will be compared with those from a "garden plot", nearby, where the seedlings are transplanted into areas cleared of vegetation. To complement this study, critical resources -- the soil nutrients, water and light -- are being

measured by research assistant Vicki Kelly to see if their availability is reduced by other plants. Then, by artificially providing nutrients, water or light to transplanted seedlings in future studies, the importance of resource competition can be confirmed.

Jay McAninch, an IES wildlife ecologist, will focus on the effects of herbivory on seedling establishment and growth. This summer, working with post-doctoral associate Dr. David Wood, he will study the effects of different timings and intensities of biomass reduction (leaf or branch removal) on tree seedlings under different levels of environmental stress in a test garden. The scientists will also evaluate the impact of herbivory and seedling predation on rights-of-way vegetation by transplanting tree seedlings into many different sites along rights-of-way, and then monitoring the natural rates and timing of herbivory. In addition, important data will be collected on how plant communities differ with regards to species of herbivores present.

Seedling establishment often occurs after some form of physical or human disturbance to a site. Frost heaves or dirt bike tracks, for example, might allow a plant to become established where it would otherwise be shaded and stunted; or maybe a deer's hoof scraping away the layer of leaf litter would let a seedling reach mineral-rich soil below. Predation on a seedling can also be affected by a disturbance: while small mammals may avoid even the smallest gaps in vegetation cover because of fear of predators, deer might be more apt to notice an isolated seedling growing in that same opening. This summer, research assistant Jim Hill (see article on page 3 of the Newsletter) will survey the types of natural and human-induced disturbances that occur along rights-of-way. Then, next summer, he and Dr. Canham will set up field experiments to look at the effects of different kinds of disturbances on germination, establishment and growth of tree seedlings.

Although sampling and observations go on year-round, the most active time for data collection on the rights-of-way project is spring, summer and fall; the 1988 field season began in the last week of March and will extend to November. A large group of dedicated people is required for such an ambitious project to succeed. Current full-time staff are Dr. David Wood, Judi Koch, Vicki Kelly and Jim Hill. The full-time research assistants during earlier phases of the project were Jon Kays, Karen Kays and Marty Burd. This summer Dr. Canham and colleagues are hiring up to 12 summer project assistants to join this collaborative effort to understand the ecology of utility rights-of-way of the Hudson Valley.



Dr. Charles Canham uses an all-sky camera to measure the amount of light a seedling receives.

TED SPIEGEL

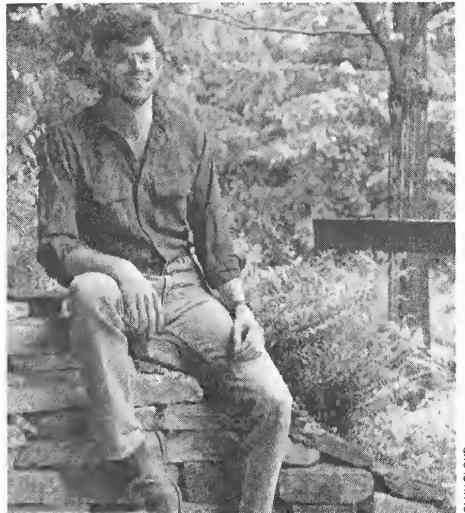
# Likens Elected to Royal Swedish Academy

Dr. Gene E. Likens, Director of the Institute of Ecosystem Studies, was recently elected a Foreign Member in the class for Botany of the Royal Swedish Academy of Sciences. Dr. Likens was notified of this honor in March 1988 by Academy Secretary General Professor Tord Ganelius.

The Royal Swedish Academy of Sciences is an independent, non-governmental organization that was founded in 1739 to promote mathematics and the natural sciences. It achieves its aims through six institutes, each with a different area of focus, through international scientific exchange programs, and through publications and informational activities. The Academy also awards research grants and prizes; perhaps the most well known of the latter are the annual Nobel Prizes.

The Academy has approximately 250 Swedish members and a quota of 134 foreign members. Of the foreign members, approximately one fourth are American. Being elected to an academy of this sort is one of the highest honors a scientist can achieve. Dr. Likens was elected to the U.S. National Academy of Sciences in 1981.

## New Staff



GUY CLOUD

**JAMES DAVID HILL**, research assistant II, is working for Dr. Charles Canham on the rights-of-way study (see page 1). He is involved with three major aspects of the project: doing an annual census of tagged seedlings in the research plots, selecting and preparing sites for a competition experiment, and surveying disturbances along rights-of-way. Mr. Hill has a bachelor of arts degree, cum laude, in biology from Hartwick College, and a master of science degree in botany from the University of New Hampshire.

# Workshop: Air Pollution and the Wilderness

One purpose of the Clean Air Act is to prevent significant deterioration of air quality. Federal land managers in charge of wilderness areas need knowledge of possible air pollution effects when they review applications for construction of major new emission sources or for modification of existing sources, on neighboring lands. To help land managers knowledgeably screen the many requests for permits that they receive annually, the Institute of Ecosystem Studies and the U.S. Forest Service co-sponsored a workshop to achieve consensus on the levels of air pollution likely to damage sensitive ecosystems. The workshop, "Effects of Air Pollution on the Wilderness", was held at the Institute from May 2-5, 1988.

Planning for the workshop began when managers from the U.S. Department of Agriculture (USDA) Forest Service contacted IES director Dr. Gene E. Likens to ask for guidance on the question of pollutant levels. Dr. Likens, James G. Byrne and Douglas G. Fox of the Forest Service, with a steering committee, co-organized the workshop. Its goal was to develop the best possible estimates as to what levels of air pollution cause damage to wilderness ecosystems. The workshop brought together 40 specialists: scientists from Canada, Norway, Sweden, the United Kingdom and the United States, and U.S. Forest Service managers. The Institute was represented by Dr. Likens, an ecologist, Dr. Gary M. Lovett, a plant ecologist, and Dr. Michael L. Pace, an aquatic ecologist. These three scientists are actively involved in research on the effects of atmospheric pollution on local as well as global ecosystems.

On the first day of the workshop IES scientists gave a primer for Forest Service managers, covering basic concepts of ecosystems, air pollution, and the effects of air pollution on terrestrial and aquatic ecosystems. The following day was devoted to a discussion of the regulations in the Clean Air Act and the Wilderness Act, and on the third and fourth days small working groups

determined critical loading values for three pollutants -- sulfur, nitrogen and ozone -- in nine representative Class I wilderness areas (areas in which only very small increments of air pollution are allowed, under the Clean Air Act.)

The group proposed a framework for classifying pollution levels for wilderness areas. Pollutant levels that fall below a "green line" -- a defined range of values -- are acceptable, and permission can be granted to go ahead with building plans. Levels that rise above a "red line" will cause definite damage to the wilderness areas and permission for building will be denied. For those operations whose deposition levels lie within the "yellow zone", with values above green but below red, permits will be delayed pending additional monitoring and research on the effects of the pollutants on the ecosystem.

Workshop participants applied these guidelines to each of the nine wilderness areas to examine the consequences of such a scheme. The report will be published this summer and the guidelines put into operation by the Forest Service managers of the various Class I wilderness areas. It was informally agreed to meet again in ten years to review the research and reevaluate green line and red line values based on new information.

Just one year ago, participants in the second IES Cary Conference, "Long-Term Studies in Ecology: Approaches and Alternatives," drafted a statement about the critical need for sustained ecological research. This statement read, in part:

Because they have common long-term goals, we propose a new partnership between scientists and resource managers ... Sustained ecological research supported by this new partnership can contribute significantly to the resolution of critical environmental problems.

In the recent workshop on air pollution and wilderness areas, scientists and managers took an important step toward achieving this critical and effective partnership.

## Local Weather

Data collected at the IES Weather Station provide background information for ecological research at the Institute and serve as a standard against which long-term trends in weather and air quality may be compared.

### March and April, 1988

Highest temperature: 22.7°C (73°F) on March 24

Lowest temperature: -14.4°C (6°F) on March 22

Daily average temperature: 5.3°C (42°F) (Normal\*: 4.9°C (41°F)

Precipitation: 8.45 cm (3.32 in.) (Normal: 17.10 cm (6.73 in.)

Average rainfall pH\*\*: 4.17

Strongest wind gust: 56 km/hr (35 m.p.h.) from the West on March 27

Prevailing wind: Northwest (307°) Average wind speed: 10 km/hr (6 m.p.h.)

\*\*"Normal" values are taken from data collected for a 30 year period at the Millbrook School

\*\*Degrees of acidity or alkalinity are indicated using a logarithmic pH scale. On the scale of 0-14, vinegar - an acid - has a pH of approximately 3, and "neutral" is 7.0. The pH of "Normal" rain is 5.6 or higher.

# Perennial Garden Highlights: June - July - August

Late June	<i>Oenothera missouriensis</i> (Evening Primrose) <i>Oenothera tetragona</i> 'Fireworks' (Sundrops) <i>Achillea millefolium</i> 'Moonshine' (Yarrow) Ornamental grass garden
Early to Mid-July	<i>Asclepias tuberosa</i> (Butterfly Weed) <i>Phlox paniculata</i> 'Star Fire' and 'Everest' (Phlox) <i>Astilbe chinensis</i> 'Pumila' Cut flower garden annuals
Mid-to Late July	<i>Rudbeckia fulgida</i> var. <i>sullivantii</i> 'Goldsturm' (Black-eyed Susan) <i>Echinacea purpurea</i> 'Bright Star' (Coneflower) <i>Liatis spicata</i> (Blazing Star) <i>Limonium</i> 'Robert Butler' (Sea Lavender)
Early to Mid-August	<i>Lobelia cardinalis</i> (Cardinal Flower) <i>Lobelia siphilitica</i> (Blue Cardinal Flower) <i>Chrysanthemum parthenium</i> (Feverfew) <i>Platycodon grandiflorus</i> 'Album' (Balloon Flower) Herb garden
Mid-to Late August	<i>Kirengeshoma palmata</i> <i>Hosta plantaginea</i> var. <i>grandiflora</i> <i>Phlox paniculata</i> 'Fujiyama'
... and many more ...	

For weekly listings, see the "Dutchess Living" section of the Taconic Newspapers.

## Library Note

The IES Circulating Collection, formerly housed at the Gifford House, has been moved to the Scientific Library in the Plant Science Building. Arboretum Members who wish to borrow books from this collection may do so while the Librarian, Annette Frank, is on duty. Members are invited to call Mrs. Frank at (914) 677-5343 ext. 311 to make arrangements for a short introduction to the new policies regarding use of the Circulating Collection.

Books on reserve for IES adult education courses are still kept at the Gifford House. Call Marcia Davis at (914) 677-5358 for information.

## Summer Calendar

### COURSES, WORKSHOPS AND ECOLOGICAL EXCURSIONS

Adult Education Program catalogues with listings for the fall semester will be mailed to Arboretum Members by mid-July. Copies will also be available at the Gifford House Visitor and Education Center, or by mail if you call the number below.

### SUNDAY ECOLOGY PROGRAMS

Free public programs are offered on the first and third Sunday of each month. All programs are from one to two hours long, and begin at 2:00 p.m. at the Gifford House on Route 44A unless otherwise noted.

Tentative schedule (please call (914) 677-5358 to confirm the day's topic):

July 3: Independence Day Weekend - no program  
July 17: Seeing the Trees for the Forest: A

Beginner's Introduction to Tree Identification  
(Alan Berkowitz) - Walk

Aug. 7 Air Pollution and the Forest: Field Work on High (Gary Lovett) - Walk

Aug. 21: Pond Ecology: Plants and Animals in a Freshwater Soup (Michael Pace) - Walk

Sept. 4: Labor Day Weekend - no program

For ecology walks, wear long pants and sturdy, waterproof footwear with socks; long-sleeved shirts or jackets are also recommended. In case of inclement weather, call (914) 677-5358 after 1 p.m. to learn the status of the day's program.

### ECOLOGICAL RESEARCH DISPLAYS

Demonstrations at the Arboretum introduce visitors to the methods and results of ecological research. The Acid Rain Study Ponds display behind the Gifford House Visitor and Education Center is open from early May through October. Here, a series of tanks that serve as model ponds (complete with aquatic animals and plants) are exposed to simulated acid rain, and the results recorded twice a week. The Pollution Garden, comparing some visible effects of atmospheric ozone on ozone-sensitive and ozone-tolerant flowering and crop plants, is adjacent to the study ponds. The Meadow Management display, at the Plant Science Building, contrasts the effectiveness of mowing vs. burning in maintaining an attractive little bluestem meadow.

### ART EXHIBIT

"The Life Forms of Leonard Cole" is an exhibit of oil paintings and charcoal sketches by Leonard Cole, father of IES aquatic ecologist Dr. Jonathan Cole. The exhibit is at the Plant Science Building and is open to the public from 9 a.m. to 4 p.m. weekdays through August 12th.

### GREENHOUSE

The IES Greenhouse performs double duty: it is a year-round tropical-plant paradise as well as a site for controlled environmental research. The public is invited to explore both aspects during Arboretum hours. There is no admission fee, but visitors should first stop at the Gifford House for a free permit.

### ARBORETUM HOURS

**May 1 - September 30:** Monday through Saturday, 9 a.m. to 6 p.m.; Sunday 1 p.m. to 6 p.m. The Gift and Plant Shops are open Tuesday through Saturday 11 a.m. to 5 p.m. and Sunday 1 - 5 p.m. (The Greenhouse and Plant Science Building continue to be closed to visitors at 4 p.m. during the summer hours.)

**October 1 - April 30:** Monday through Saturday, 9 a.m. to 4 p.m.; Sunday 1 - 4 p.m. The Gift and Plant Shops are open Tuesday through Saturday 11 a.m. to 4 p.m. and Sunday 1 - 4 p.m. Arboretum closed on public holidays. (Also closed during the deer hunting season and when roads are snow-covered.)

All visitors must obtain a free permit at the Gifford House for access to the Arboretum. Permits are available up to one hour before closing time.

### MEMBERSHIP

Become a member of the Mary Flagler Cary Arboretum. Benefits include a special member's rate for IES courses and excursions, a 10% discount on purchases from the Gift Shop, six issues of the IES Newsletter each year, free subscription to *Garden* (the beautifully illustrated magazine for the enterprising and inquisitive gardener), and parking privileges and free admission to the Enid A. Haupt Conservatory at The New York Botanical Garden in the Bronx. Individual membership is \$25; family membership is \$35. For information on memberships, contact Janice Claiborne at (914) 677-5343.

For more information, call (914) 677-5358 weekdays from 8:30 - 4:30

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